

ABSTRACT

[0044] The present disclosure concerns methods and apparatus comprising both exothermic and endothermic hydrogen generators. In certain embodiments of the invention, such hydrogen generators may be used to provide hydrogen fuel to a fuel cell. The use of both exothermic and endothermic hydrogen generators is advantageous for providing thermally efficient hydrogen storage systems that reduce or eliminate the formation of waste heat resulting from hydrogen generation. In some embodiments of the invention, the exothermic hydrogen generator comprises a sodium borohydride hydrogen generator and the endothermic hydrogen generator comprises a metal hydride storage system. In various embodiments of the invention, the rates of exothermic and/or endothermic hydrogen generation may be controlled. Control of exothermic and/or endothermic hydrogen generation may provide endothermic or thermally neutral hydrogen production. In certain embodiments of the invention, the thermally efficient hydrogen storage system may be used to provide electrical power to a portable electronic device.